ICED
Integrating Climate and Ecosystem Dynamics

ICED-IPY

Integrating **C**limate and **E**cosystem **D**ynamics :

Analysing Circumpolar Southern Ocean Ecosystems

Professor Eugene Murphy

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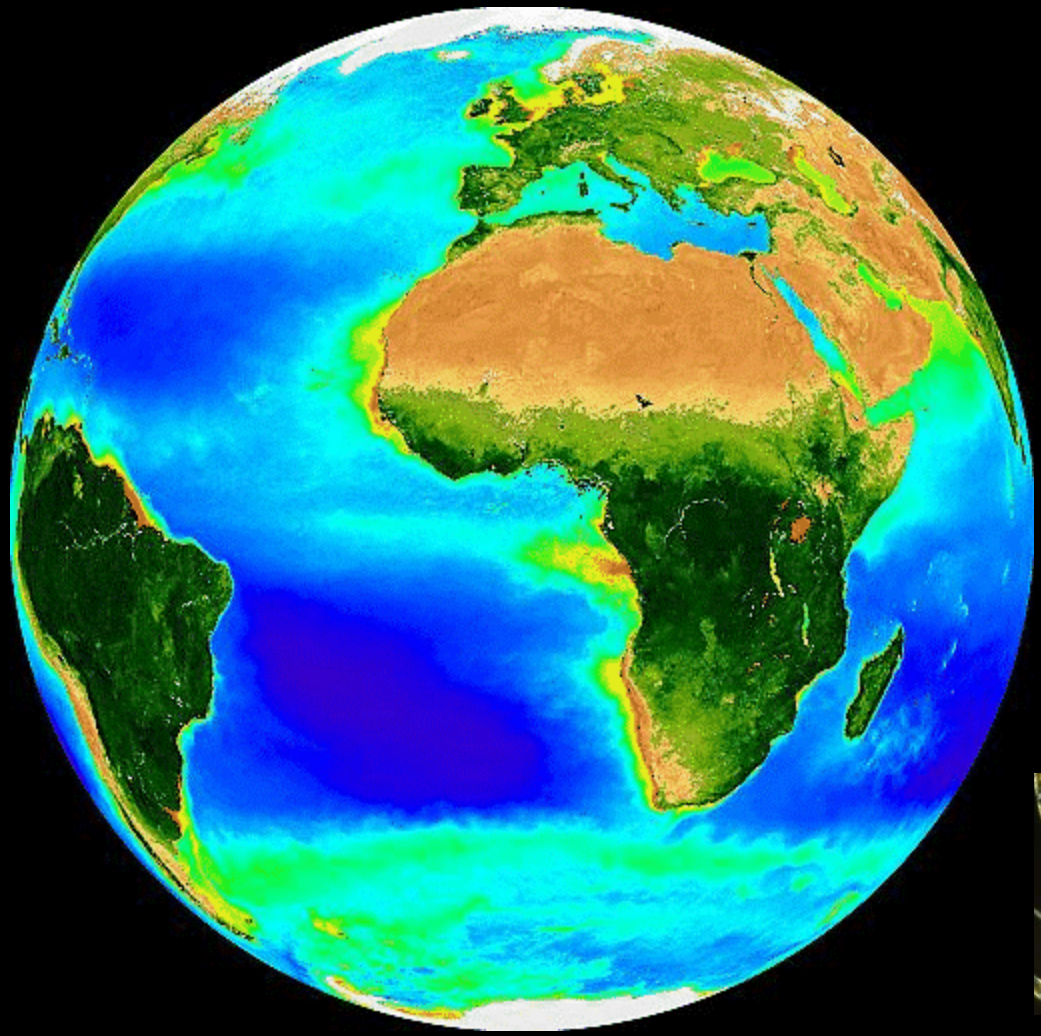
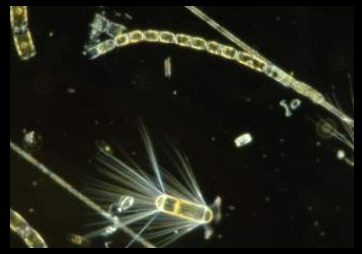
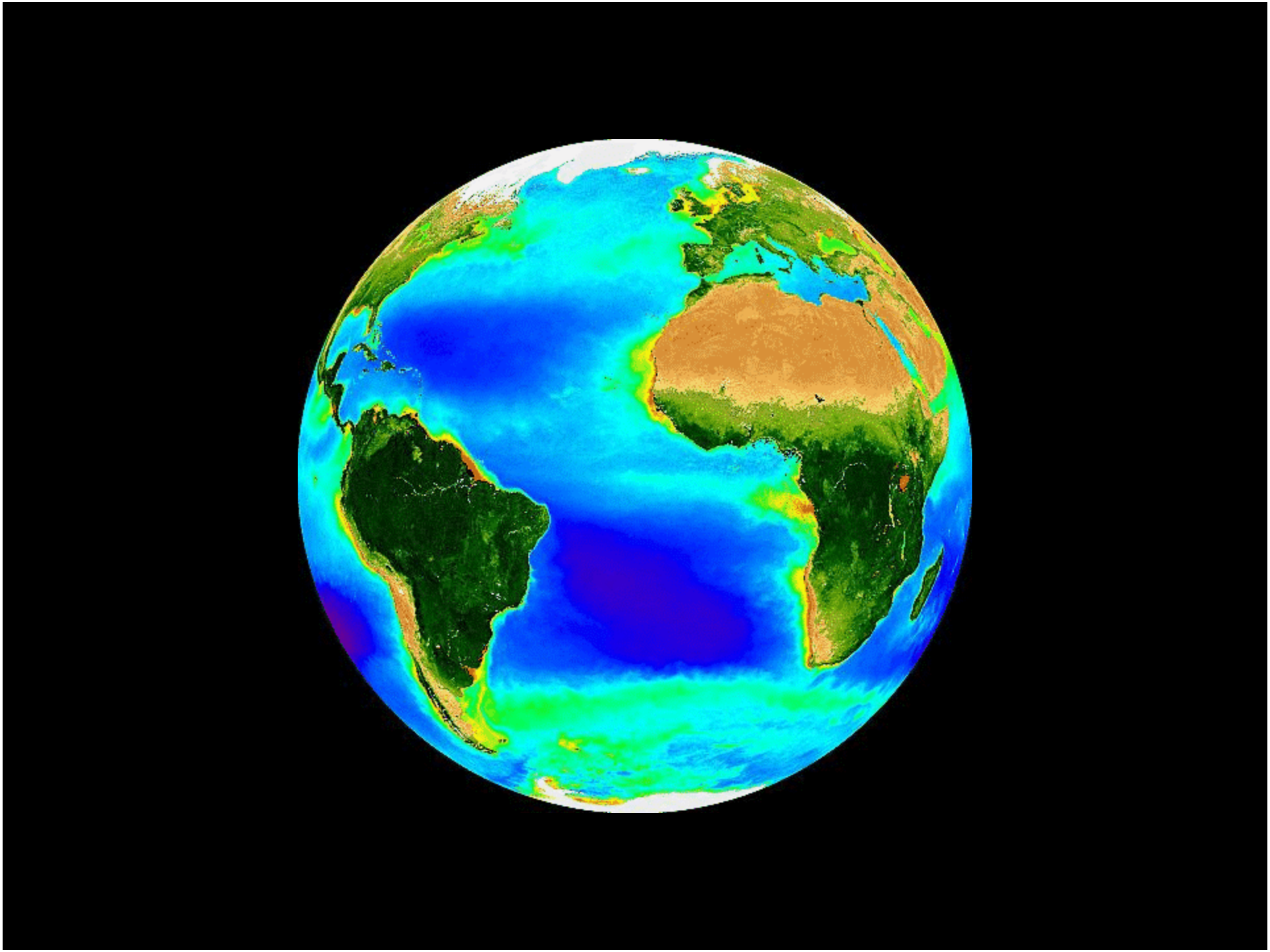
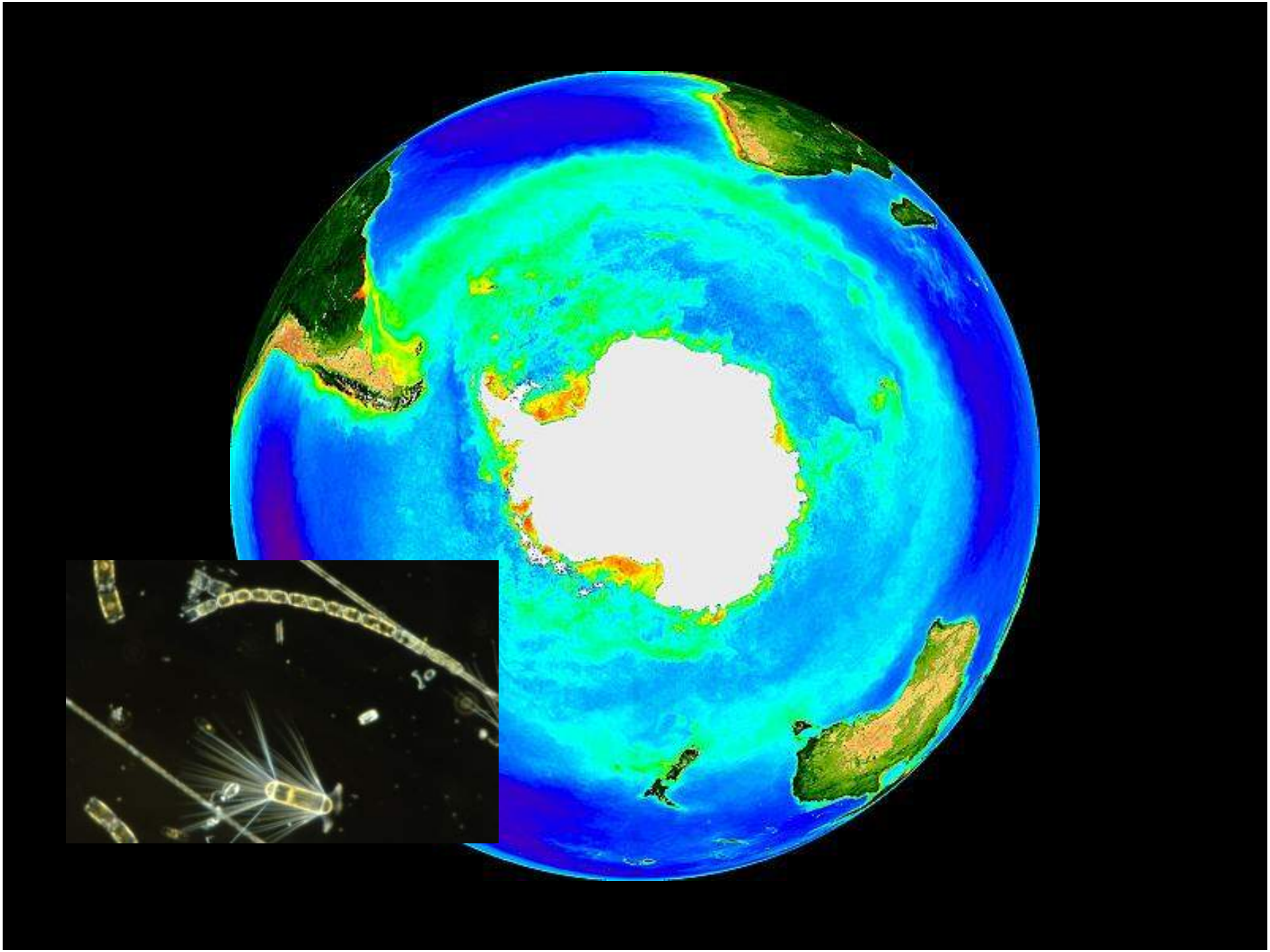
Global Ocean





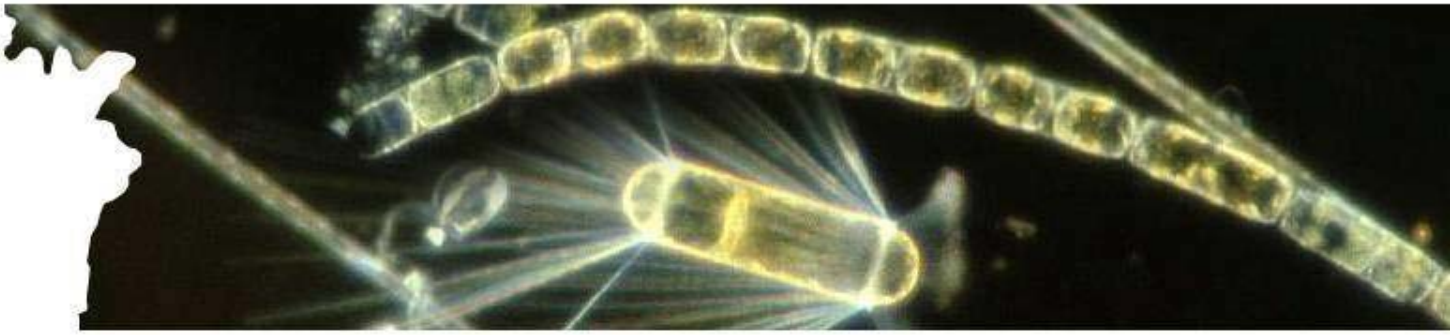
Ocean ecosystems are a major component of the biosphere





Ocean ecosystems are important in global carbon budgets

Oceans & Climate



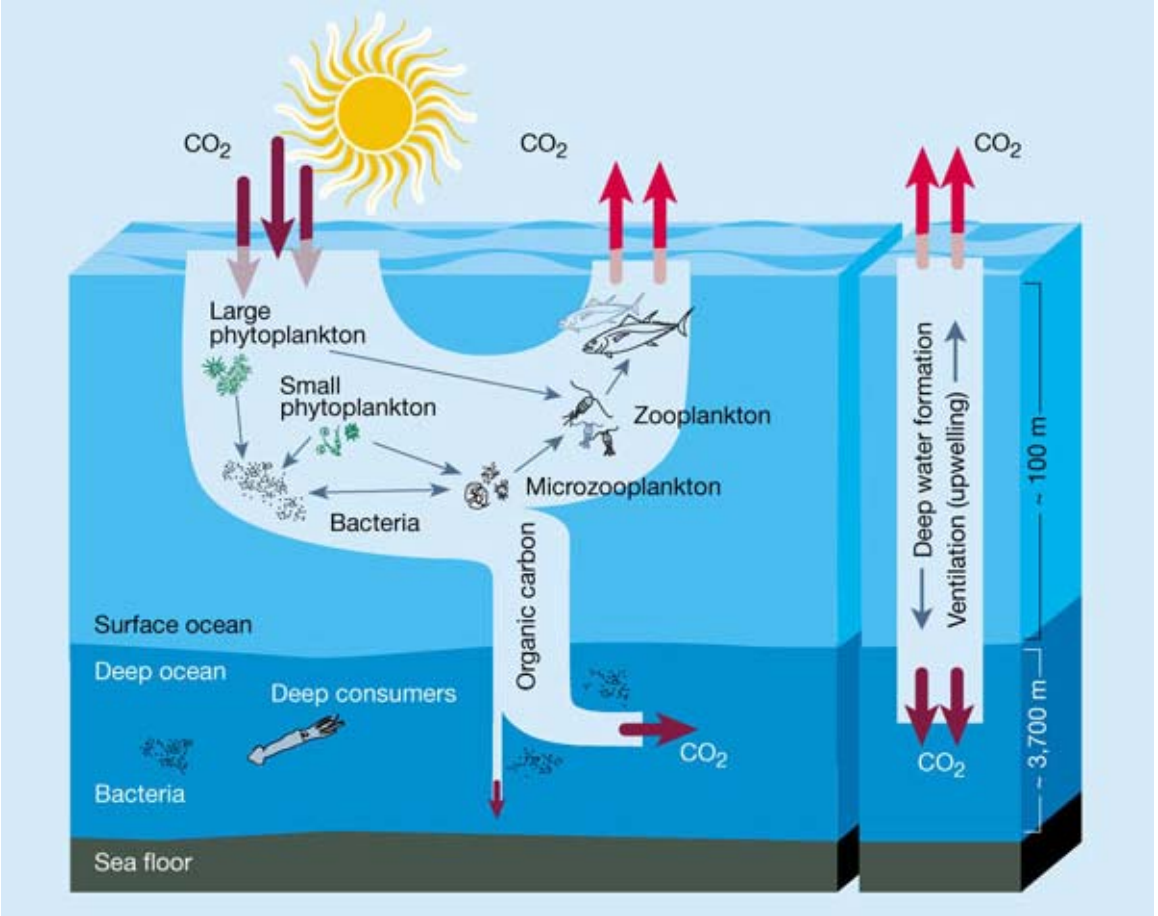
"Biological pump"

Carbon (CO_2) ->

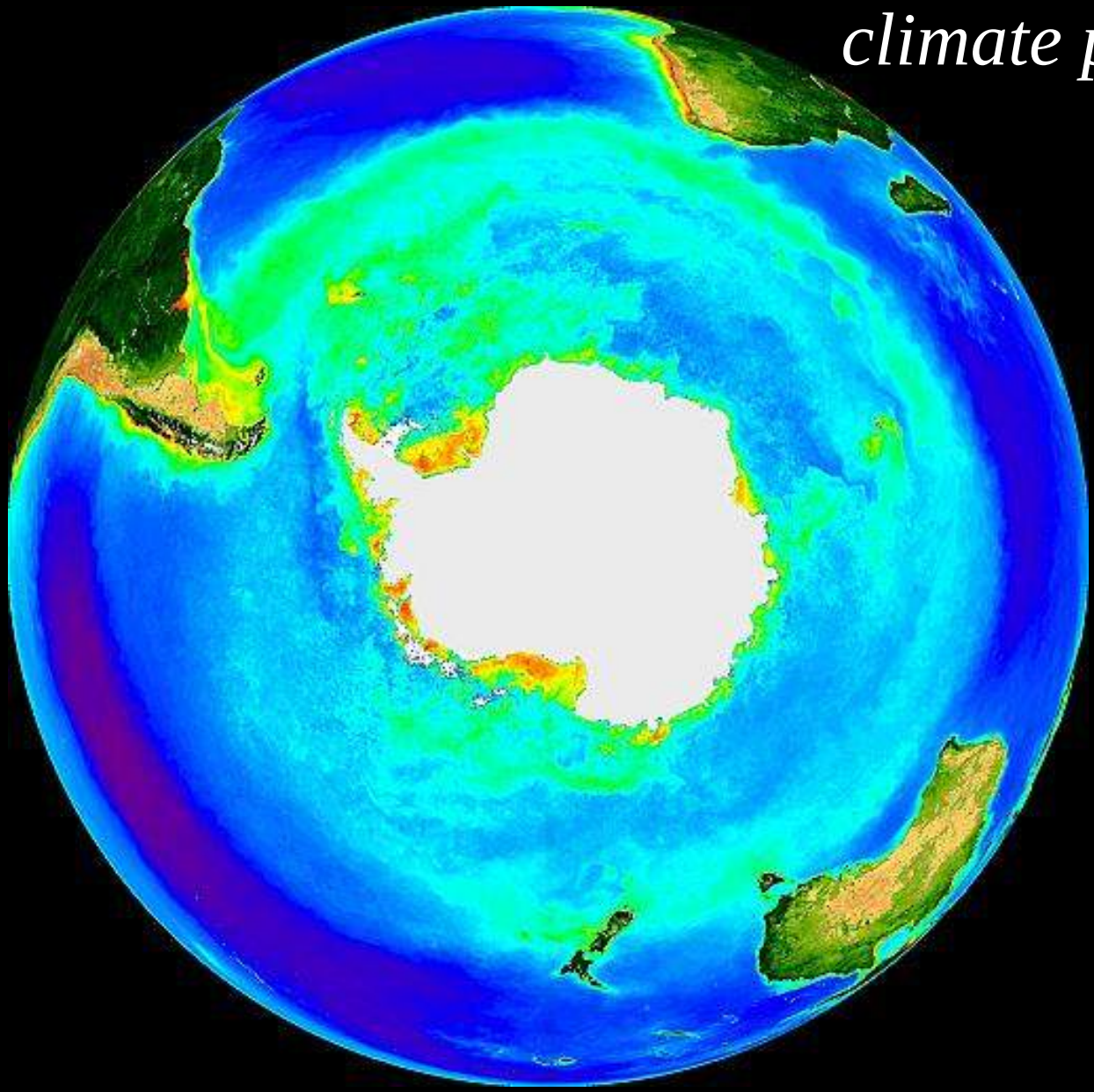
Absorbed into ocean-> taken up by phytoplankton

-> Sinks to deep ocean

-> Lost from atmosphere for > 10000 years

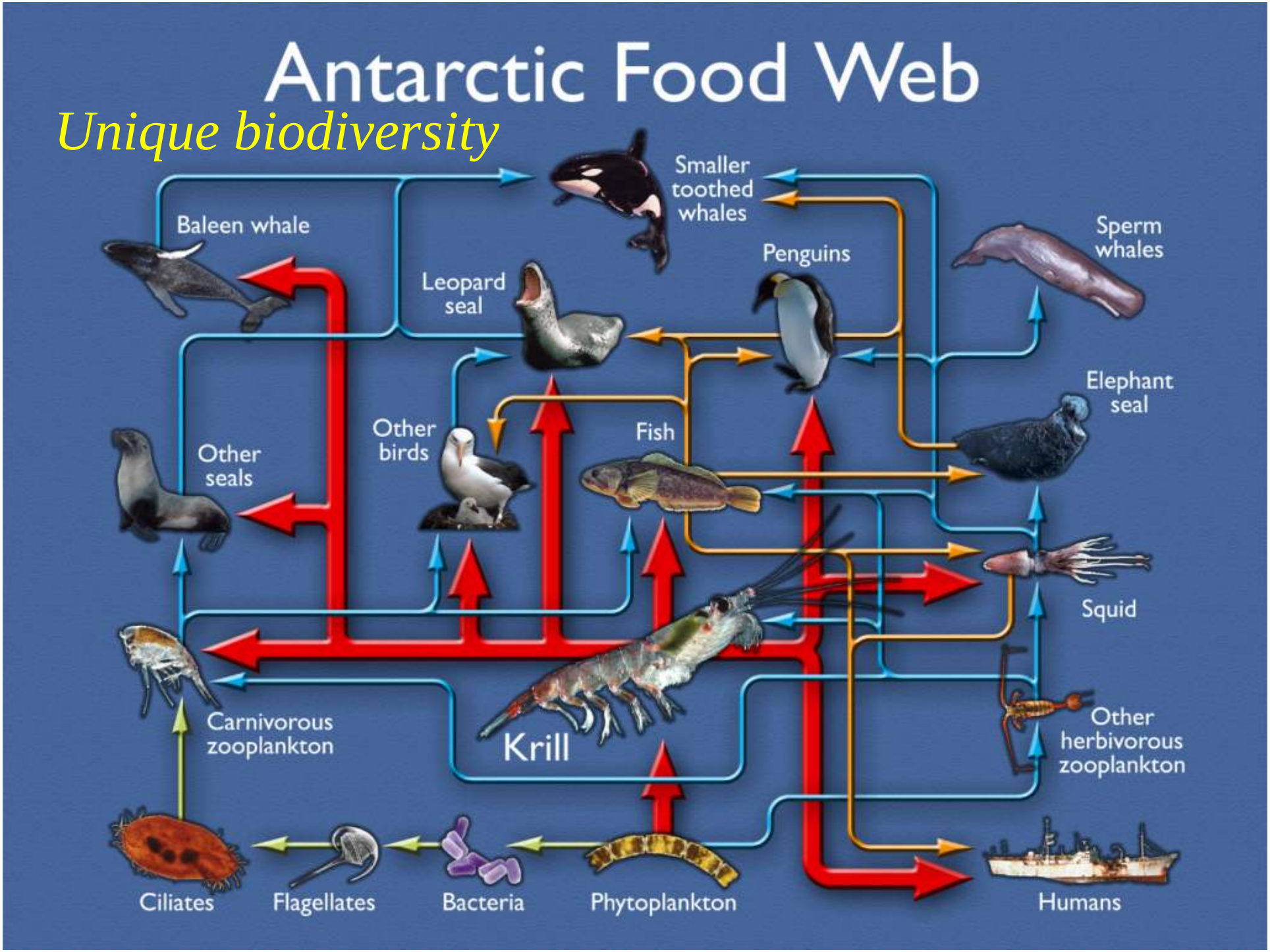


Antarctic ecosystems have a key role in global climate processes



Antarctic Food Web

Unique biodiversity



Sustainable management of Southern Ocean fisheries is crucial for global food security

Fisheries

- ***Over-exploitation***

- Harvesting has generated massive perturbation over more than 2 centuries

- ***Global problem***

- International fleets operate globally
- Need to maintain food security

- ***Exploitation increasing***

- Krill fishing increasing
- Other species are affected
    - *e.g.albatrosses die on long-line hooks*

- ***Management of harvesting***

- Requires understanding of wider ecosystem operation

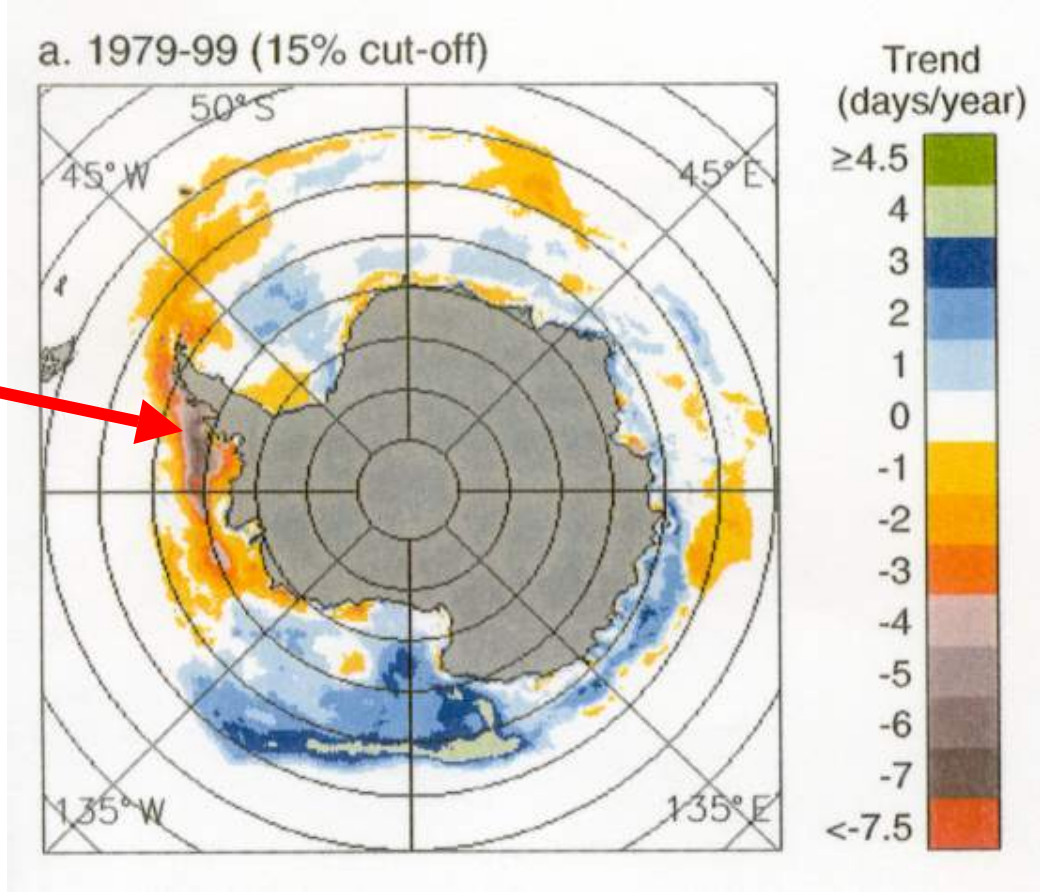
There have been major physical changes in the Southern Ocean over the last 50 years

Climate changes

There have been major changes in winter sea ice duration (Parkinson 2002 *Ann Glaciol* 34)

The Antarctic Peninsula region is one of the most rapidly warming regions on the planet

There has been a marked reduction in sea ice and upper ocean temperatures increased 1°C in 50 years



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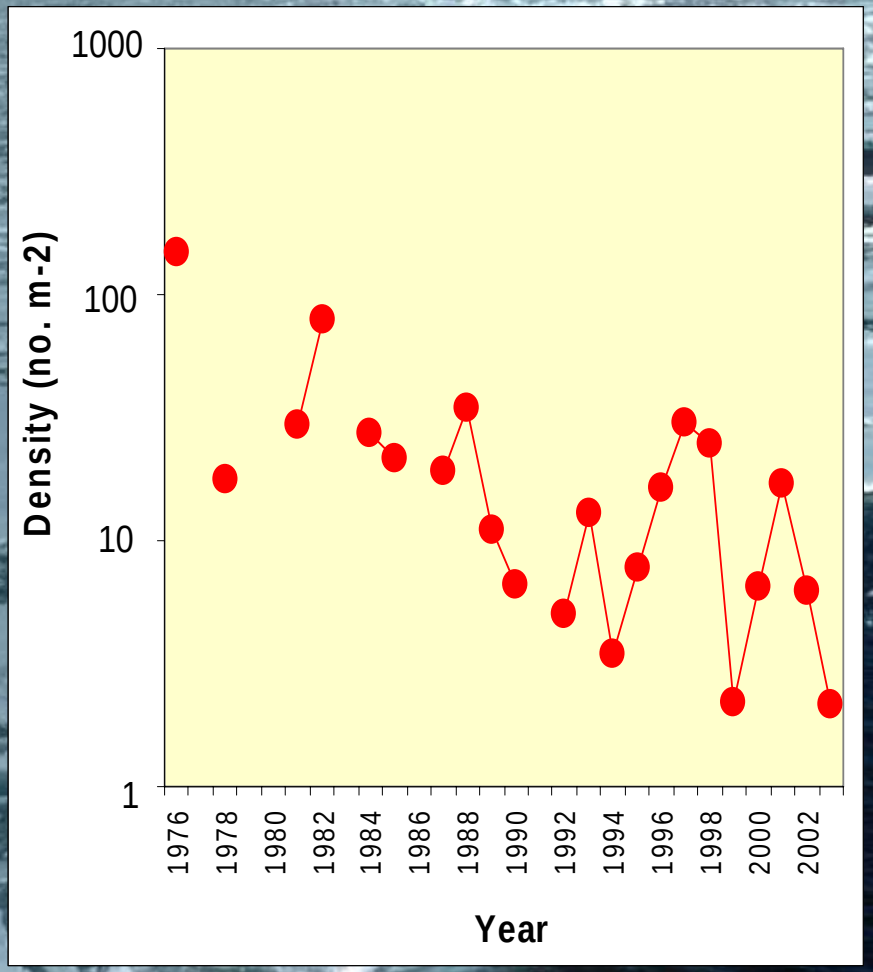
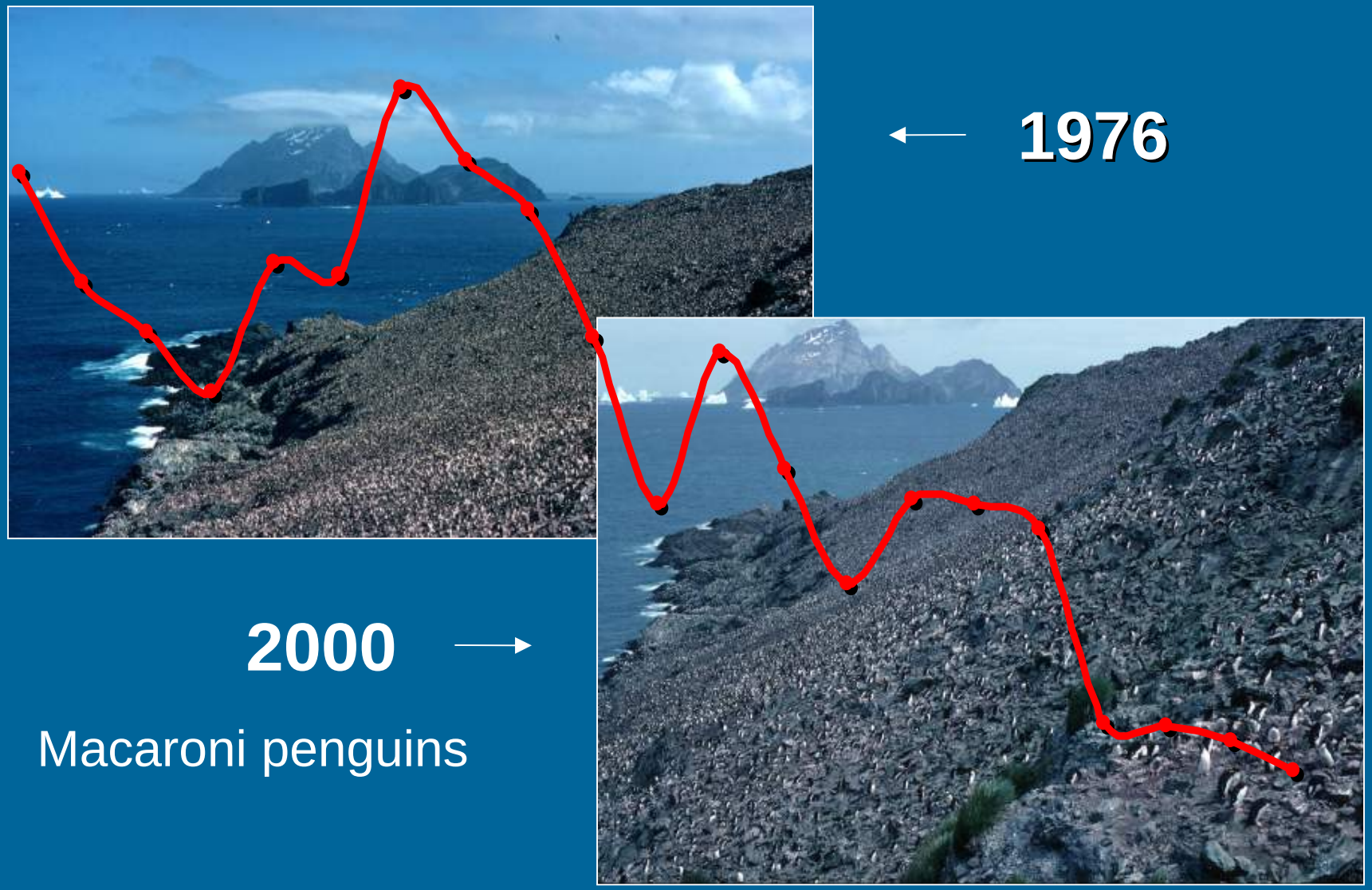
There have also been major biological changes

Declining krill population



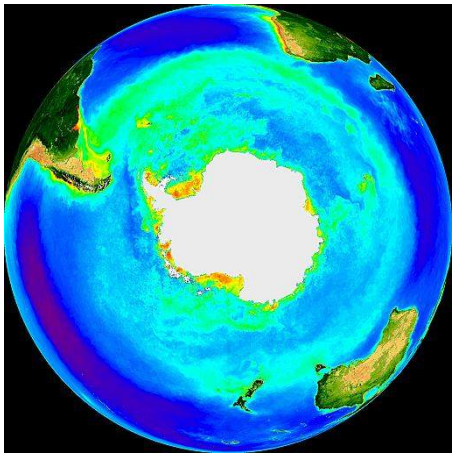
More than 50% reduction of krill in the Atlantic region over the last 30 years

Predator populations are also changing



Antarctic Ecosystems

Important in global climate processes and in maintaining food security and unique biodiversity



Major changes are occurring as a result of harvesting impacts and climate change effects

To address these issues requires:

Integrated circumpolar analyses of ecosystem operation
Integration and coordination of international research effort

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ICED-IPY

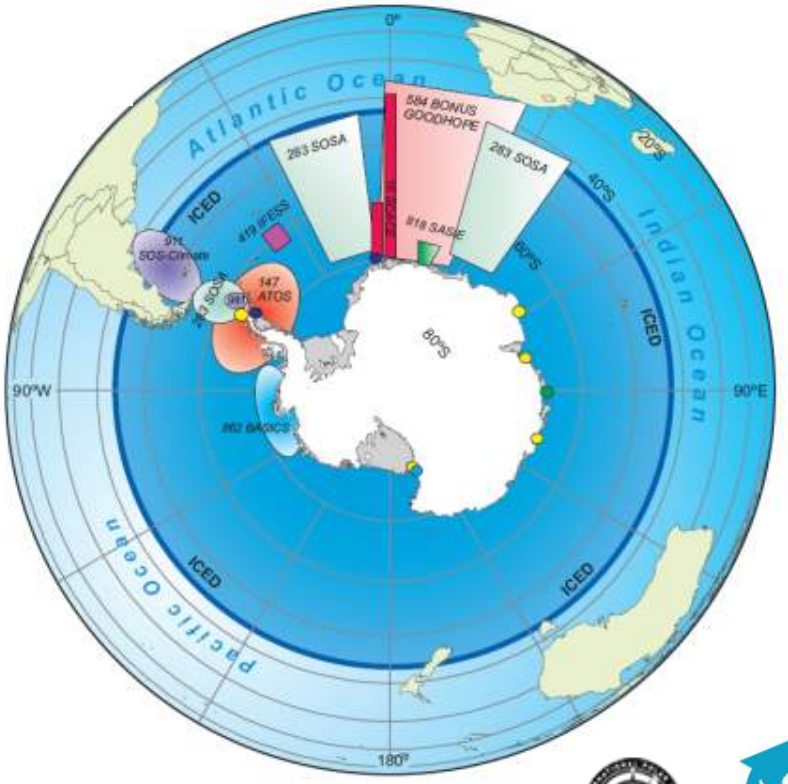
- **ICED-IPY will lead *Ecosystems and Biogeochemistry of the Southern Ocean* activities under IPY**

- **Partnership with the Southern Ocean System of the European Network of Excellence (EUR-OCEANS)**

- **Will integrate activities with other Southern Ocean international programmes and IPY groups**

- **ICED-IPY will facilitate the coordination of existing studies, and develop regional comparisons**

Map of proposed fieldwork locations for projects coordinated by or linked to ICED-IPY



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ICED-IPY

Multidisciplinary collaboration between Australia, Belgium, Brazil, Canada, Chile, China, Finland, France, Germany, Japan, Korea, Netherlands, New Zealand, Norway, Russia, Spain, UK and the US

SCACE: Synoptic Circum-Antarctic Climate-processes and Ecosystem study.

ATOS: Atmospheric inputs of organic carbon and pollutants to the polar ocean: rates, significance & outlook.

SOSA: Physical and biogeochemical fluxes in the Atlantic Sector of the Southern Ocean.

Effects of CO2 on CaCO3 accretion and primary productivity.

IFESS: Iron Fertilisation Experiment in the Scotia Sea.

BONUS-Goodhope: Biogeochemistry of the Southern Ocean: interactions between NUtrients, dynamics, and ecosystem Structure.

SASIE: Study of Antarctic Sea Ice Ecosystems.

BASICS: A year-round study of Biogeochemistry of Antarctic Sea Ice and the Climate System.

SOS-CLIMATE: Southern Ocean Studies for Understanding Global-CLIMATE Issues.

Carbon in Sea Ice: Fluxes and Biogeochemistry.

CLIMANT: Climate change in Antarctica: pelagic-benthic coupling approach to extremes of the Weddell Sea.

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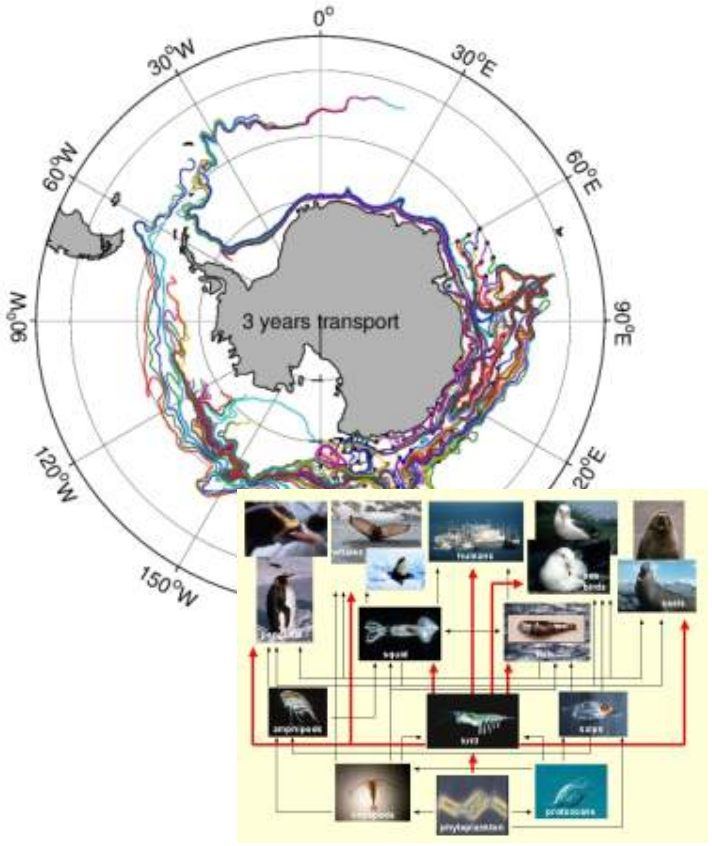
http://www.antarctica.ac.uk/Resources/BSD/ICED/index.htm

ICED-IPY Key scientific issues

ICED-IPY will develop regional to circumpolar scale analyses of the operation of Southern Ocean ecosystems focusing on:

1. *Climate-ocean interactions and impacts on regional ecosystems*
2. *Ecosystem controls on biogeochemical cycles*
3. *Ecosystem basis for the sustainable management of exploitation*



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Coordination & Integration

ICED-IPY Core Activities

Activities

- Data synthesis and collation of historical data
- Development of integrated ecosystem models
- Field studies -coordination

  Utilising and developing new technology – remote monitoring

- Developing education & training

  PhD Students, Exchanges, Summer Schools

  Important link with EUR-OCEANS

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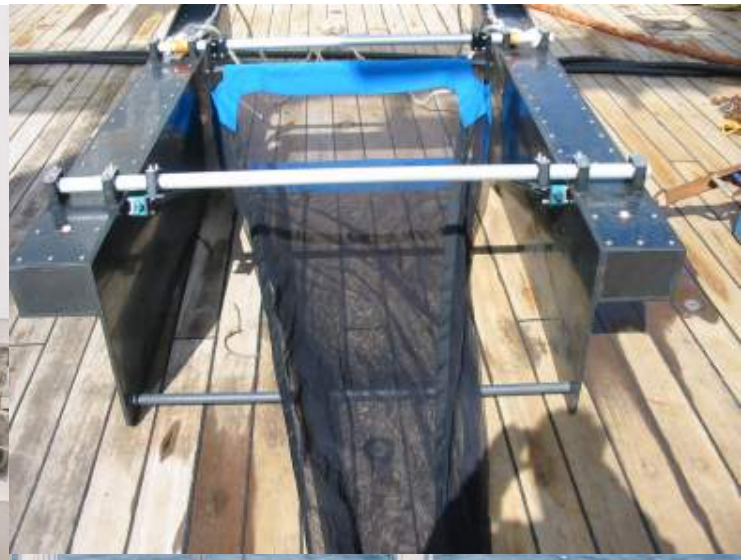
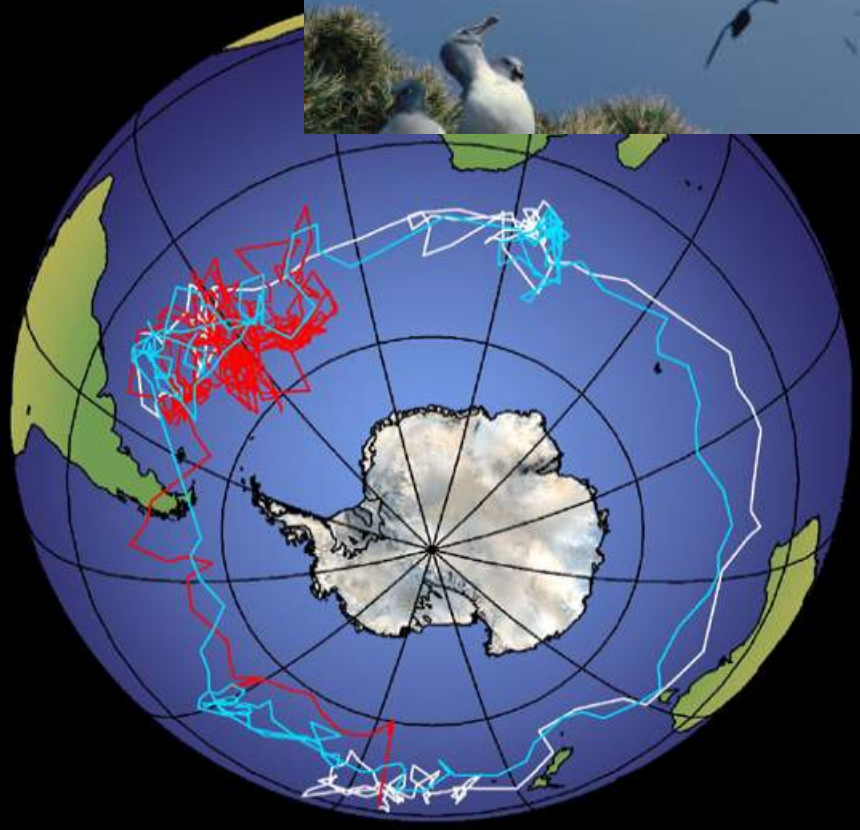






Grey-headed Albatross



Geo-locators – use light to work out latitude

Circumpolar flight over 2 years

Acknowledgements

ICED-IPY

Project Leaders & Steering Committee

Volker Strass, Alfred-Wegener-Institut, Germany

Carlos Duarte, IMEDEA, Spain

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SCAR

Oceans

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GLOBEC

International Council for Science
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http://www.antarctica.ac.uk/Resources/BSD/ICED/index.htm

Summary

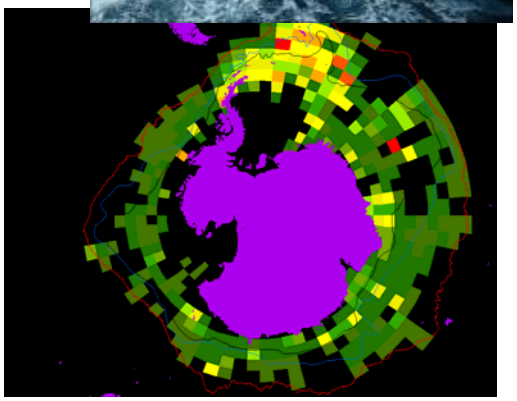
Southern Ocean ecosystems are important in global climate processes and in maintaining food security and unique biodiversity

ICED-IPY

Will be a major ***catalyst for integration*** activities during the next few years

Developing a ***coordinated international approach*** to Southern Ocean studies of climate, biogeochemistry, ecosystems and fishery impacts

Undertaking ***integrated circumpolar analyses*** to address globally important science questions



=> ***Lasting legacy***

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ICED programme over the next decade

http://www.antarctica.ac.uk/Resources/BSD/ICED/index.htm